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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10 036,388	01 07 2002	Takenobu Kishida	60188-415	3663

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WASHINGTON, DC 20005-3096

EXAMINER

CAO, PHAT X

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 08 19 2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/036,388

Applicant(s)

KISHIDA ET AL.

Examiner

Phat X. Cao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 11 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 19-36 is/are pending in the application.
- 4a) Of the above claim(s) 31-36 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 19-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2,4,9
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Election/Restrictions

1. Applicant's election of claims 19-30 in Paper No. 8 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Specification

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 19-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cabral, Jr. et al. (US. 6,437,440) in view of Kwon et al., Materials Research Society, pp. 711-716 (cited by Applicant).

Cabral (Fig. 3) discloses a semiconductor device, comprising: an insulating film (54,12) including a fluorine component (column 4, lines 17-21) and formed on a semiconductor substrate; a lower interconnect 24 formed in the insulating film 54; a via hole 11 formed on the lower interconnect and in the insulating film; an interconnect groove 17 formed in an upper region of the via hole and in the insulating film; a plug

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composed of a copper film 24' buried in the via hole 11; an upper interconnect buried in the interconnect groove 17; and a barrier layer 23 formed between the insulating film and the plug, the insulating film and the upper interconnect, and the plug and the lower interconnect, wherein the conducting film 24' comprises copper, and wherein the barrier layer 23 is composed of a laminated film including a lower first barrier layer of tantalum nitride containing 30-60 % nitrogen (column 2, lines 49-54) and an upper second barrier layer of alpha-tantalum (column 4, lines 15-18).

Cabral does not disclose the upper second barrier layer of tantalum having a beta-crystal structure.

However, Kwon (pages 711-716) teaches the forming of copper film on the tantalum barrier layer having a beta-crystal structure. Accordingly, it would have been obvious to form Cabral's upper second barrier layer of tantalum having a beta-crystal structure because as taught by Kwon, such beta-tantalum layer would promote the adhesion of copper film and would provide large copper grains with a strong (111) texture obtained owing to the heteroepitaxial growth of Cu on the beta-tantalum layer (see abstract).

5. Claims 25-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cabral, Jr. et al. (US. 6,437,440) in view of Kwon et al (Materials Research Society, pp. 711-716) and Grill et al (US. 6,346,747).

As discussed in details above, the combination of Cabral and Kwon substantially

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reads on the above claims, except it does not disclose that the interlayer insulating film 12 of Cabral's Fig. 3 is divided into a first interlayer insulating film and a second interlayer insulating film.

However, Grill (Figs. 4 and 5) teaches the dividing of the interlayer insulating film 44 into two separate layers 84 and 86, and forming a plug and an upper interconnect into these two separate layers (column 9, lines 24-36). Accordingly, it would have been obvious to divide the interlayer insulating film 12 of Cabral into first and second interlayer insulating layers and to form the plug and the upper interconnect into these two separate insulating layers, because as taught by Grill, such dividing would provide superior interconnect depth control (column 9, lines 24-36).

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is (703) 308-4917. The examiner can normally be reached on Monday - Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

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PC

August 8, 2003



CARLOS A. LOPEZ
PRIMARY EXAMINER